North Carolina Occupational Safety and Health Education and Research Center
University of North Carolina at Chapel Hill
Principal Investigator: Bonnie Rogers

Annual Report
July 1, 2013 – June 30, 2014

SECTION I: ERC Summary and Relevance, and Current Contact Information

ERC Summary

The North Carolina Occupational Safety and Health Education and Research Center (NC OSHERC) is located at the University of North Carolina, Gillings School of Global Public Health with collaborating units at NC State University (NCSU) and Duke University. Academic training is provided in the core disciplines of Occupational Health Nursing, Safety and Ergonomics (NCSU), and Occupational Medicine (Duke University). In addition, specialized training in Occupational Epidemiology is available. An allied program in Occupational Exposure Science, replacing the former Industrial Hygiene program, is at UNC. Both master's and doctoral degrees are offered. There are more than 50 faculty within the NC OSHERC with more than 100 enrolled students each year in these programs. We also offer an extensive Continuing Education (CE) program.

The mission of the NC OSHERC at UNC-Chapel Hill is to provide high quality education, research training, and research in the occupational health and safety sciences to protect worker health. Research and multidisciplinary interactions are the foundation of this process. **Education**: Train occupational health and safety professionals to acquire an expanded knowledge base, provide occupational health and safety services, and develop research skills. **Research**: Define and develop the discipline of the occupational health and safety sciences to reduce work-related health hazards and improve worker health and working conditions. The purpose of the program is to:

1. Train practitioners and researchers in the academic disciplines of occupational medicine, occupational health nursing, safety/ergonomics, occupational epidemiology, and occupational exposure science in the field of occupational health and safety.
2. Provide interdisciplinary learning experiences through coursework, field projects, and seminars.
3. Provide a continuing education training program to meet the needs of practitioners and those interested in occupational safety and health.

Programs are offered at the master's and doctoral level in the different academic disciplines, or post-doctoral level in medicine. Training activities include coursework, practica seminars, field projects, and research activities, many which are interdisciplinary in nature. Distance education is an option for the OHN Program.

A variety of individual CE interdisciplinary courses are offered on-site, on contract basis, or through our week-long Summer and Winter Institutes. In addition to the continuing education, seminars with topics relevant to education, research, and practice in all disciplines are offered quarterly through the NORA (National Occupational Research Agenda) Interdisciplinary Seminar Series. Interdisciplinary collaboration is a key component of the NC OSHERC among faculty, students, and community partners engaging in joint projects to improve worker health

and safety. Outreach to the local occupational safety and health community is an integral part of the NC OSHERC.

Relevance

This education and research program is designed to prepare practitioners and researchers in occupational health and safety. These professionals work to protect and promote the health and safety of our nation's workforce. Education and research in occupational health and safety is essential to eliminate these hazards and make the workplace safer and healthier for all workers.

Key Personnel

Name	Role in ERC	Contact Information
Bonnie Rogers	Principal Investigator, NC OSHERC; Program Director, Occupational Health Nursing	UNC-Chapel Hill 919-966-1765 rogersb@email.unc.edu
Susan Randolph	Deputy Director, NC OSHERC; Faculty, Occupational Health Nursing	UNC-Chapel Hill 919-966-0979 susan.randolph@unc.edu
Dennis Darcey	Program Director, Occupational Medicine	Duke University 919-684-3591 dennis.darcey@duke.edu
David Kaber	Program Director, Occupational Safety & Ergonomics	North Carolina State University 919-515-0312 dbkaber@ncsu.edu
Leena Nylander-French	Program Director, Occupational Exposure Science	UNC-Chapel Hill 919-966-3826 leena_french@unc.edu
David Richardson	Program Director, Occupational Epidemiology	UNC-Chapel Hill 919-966-2675 david.richardson@unc.edu
Kathleen Buckheit	Director, CE Program	UNC-Chapel Hill 919-962-2101 buckheit@email.unc.edu

ERC Web Link

http://osherc.sph.unc.edu/

SECTION II: Program Highlights of High Impact Outcomes

Occupational Medicine
Program Director: Dennis Darcey

OMR resident David Caretto, MD, MPH completed his master's research paper, "Association between exercise frequency and health care costs within an employee population at large university." There were 16,154 employees enrolled in fitness and wellness programs who were evaluated to see if exercise led to decreased health care costs over a 10 year period. A statistically significant association was found between exercise frequency and reductions in total annual medical and pharmacy costs paid independent of BMI category. The study will be submitted for publication. OMR resident Scott welch, MD, MPH completed his master's paper, "Advanced Vitality at IBM:A New Direction for Workplace Health Promotion." The paper evaluates a new internet based well-being resource designed to promote healthy habits that lead to overall fulfillment, giving employees a greater sense of purpose in their own lives'.

OMR faculty member John Dement, PhD serves on the Exposure Assessment Workgroup for the NIEHS Gulf Long-Term Follow-Up Study for Oil Spill Clean-Up Workers and Volunteers and the NIOSH World Trade Center - Scientific/Technical Advisory Committee. OMR faculty member Debra Hunt, DrPH, CBSP, Director of Biosafety at Duke University, was recently appointed by the CDC Director to serve on the Laboratory Safety Advisory Group to the Advisory Council of the Director. As a member of the American Society for Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) committee for Standard 188P, OMR Faculty member Wayne Thomann, PhD, Director of Duke Environmental Health and Safety, contributed to the development of a new standard aimed at reducing the risk of Legionellosis in building water systems.

OMR provided continuing education programs in occupational health and safety for over 1200 professionals.

Occupational Health Nursing
Program Director: Bonnie Rogers

Bonnie Rogers, Program Director, completed the Bioethics and Health Policy Academic Certificate Program from Loyola University in Chicago, IL. , December, 2013. She was also elected as a Fellow of the Collegium Ramazzini, an international society that aims to prevent disease and improve health through the examination of critical issues in occupational and environmental medicine. Bonnie will be acknowledged as a new fellow at the organization's annual meeting held October 24-26, 2014.

Three current OHN students received Public Health Nursing awards. Saundra Trouslot received the Imogene Pence Klingenfus Award, and Laurie Heagy and Nancy Kim both received the Margaret Blee-Ruth Warwick Hay Award.

Dr. Rogers was PI on the REACH II "Integration of Respirator Protection into Practice Among Health Care Workers Exposed to Influenza" project. The project involved observations, focus groups, and knowledge-based workshop. Project results included the need for comprehensive respiratory protection policies with substantial oversight ; consistency in fit-

testing procedures, education (many elements were lacking), and evaluation; clear evaluation of the entire respiratory protection program with compliance; promotion and protection of worker health not allowing workers to fall through the cracks; respiratory protection of visitors; engagements for all related to responsibility. In addition, nine competencies were developed and are recommended for use for any exposed worker.

Occupational Safety & Ergonomics (OSE) Program
Program Director: David Kaber

During the reporting period NIOSH trainees contributed as authors/co-authors to the publication of five journal articles with topics ranging from quantification of driver distraction due to on-road signage, trade-offs among cognitive and physical task performance in multi-tasking scenarios, design of prototype cockpit displays for pilot traffic awareness and threat assessment, as well as evaluation of touch-pad surfaces for control accuracy and speed in human-computer interaction.

Trainees also contributed to four refereed conference proceedings papers and one other conference paper. Three trainees gave presentations at the *2013 IEEE International Conference on Systems, Man, and Cybernetics* (Manchester, UK) with topics including measures of three-dimensional motion behavior in virtual reality (VR) simulation for motor skill training. One PhD student also gave a presentation on the effectiveness of visual and haptic (force-feedback) aids in VR simulation for motor skill training at the *15th International Conference on Human-Computer Interaction* (Las Vegas, NV).

The OSE Program also received supplemental funding for one pilot project during the reporting period with a focus on biometric evaluation of psychomotor test performance. The objective of this research was to validate use of a VR-based haptic simulation of block design task performance for motor skill testing and training by comparison of electromyography (EMG) measures with native/physical task performance. In general, results revealed the patterns of EMG for several muscle groups to be statistically identical across the VR and native versions of the task. This work is important because the use of VR for such psychomotor testing provides flexibility in terms of specific training condition delivery as well as the capability to record many kinematic features of user motion, etc.
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Three NIOSH trainees graduated during the reporting period, including one PhD student (Clamann) and two masters' students (Corbett and Pankok). Dissertation and thesis topics included, "the use of adaptive haptic forces in a virtual environment for fine motor skill training," "the effects of haptic feedback and visual distraction on pointing task performance in 3D haptic virtual environments," and "mitigating biases in time-to-contact judgments with general aviation cockpit displays of traffic information." The PhD student is currently working as a user experience expert for a private company. One master's student went to work as a consultant and the other continued in the PhD program at NC State. Related to these graduations, three new trainees joined the OSE Program this fall including two doctoral and one masters student.

Occupational Epidemiology
Program Director: David Richardson

The Occupational Epidemiology program has been fortunate to have an exceptional group of highly productive graduate trainees that have been presenting at international conferences and collaborating with faculty on publications. For example, former trainee Kim Angelon Gaetz, was a recipient of an ERC pilot grant, and now has completed her dissertation which focused on respiratory health among North Carolina public school teachers. She received an EPA Star Fellowship, and recently took a post-doctoral job with USEPA continuing research on indoor air quality, with a focus on schools. Trainee Alex Kiel recently completed his dissertation on analyses of mortality among Colorado Plateau uranium miners; he received an award for best poster by a young investigator at EPICOH (Epidemiology in Occupational Health) in Chicago, Il (2014) and was awarded a post-doctoral traineeship at UNC-CH. Former trainee Ghassan Hamra completed his post-doctoral traineeship at the International Agency for Research on Cancer, where he worked on the International Study of Nuclear Industry Workers. Dr. Hamra has received a faculty appointment in the Department of Occupational and Environmental Epidemiology at Drexel University.

Dr. Richardson, program director, is currently serving on the National Academy of Sciences' Institute of Medicine, Committee on Agent Orange. He continues to serve on the Presidential Advisory Board on Radiation and Worker Health, and as Associate Editor for Occupational and Environmental Medicine, American Journal of Epidemiology, and Environmental Health Perspectives.

Trainee Publications (Current and recent former trainees indicated in **BOLD**)

Hamra GB, Loomis D, Dement J. Examining the association of lung cancer and highly correlated fibre size-specific asbestos exposures with a hierarchical Bayesian model. *Occup Environ Med*. 2014 Feb 25. doi: 10.1136/oemed-2013-101965.

Hamra G, MacLehose R, Bertke S, Daniels RD, Richardson DB. Modeling complex mixtures in epidemiologic analysis: additive versus relative measures of differential effectiveness. *Occupational and Environmental Medicine* (2014) 54(12):1533-8. PMID: 24213566.

Hamra G, MacLehose R, Wing S, Richardson DB. Integrating informative priors from experimental research with Bayesian methods: an example from radiation epidemiology. *Epidemiology* (2013) 24: 90-95. PMID: 23222512.

Hamra G, MacLehose R, Richardson DB. Markov-Chain Monte Carlo: An introduction for epidemiologists*. International Journal of Epidemiology* (2013) 42:627-634. PMID: 23569196.

Richardson DB, **Kiel A**, Wing S, Wolf S. Mortality among workers at Oak Ridge National Laboratory. *American Journal of Industrial Medicine* (2013) 56(7):725-32. PMID: 23460075.

Beard JD, Hoppin JA, Richards M, Alavanja MC, Blair A, Sandler DP, Kamel F. Pesticide exposure and self-reported incident depression among wives in the Agricultural Health Study. *Environ Res*. 2013 Oct;126:31-42. doi: 10.1016/j.envres.2013.06.001.

Occupational Exposure Science
Program Director: Leena Nylander-French

Matthew Stiegel, OES trainee, and Dr. Pleil, OES faculty member, collaborated with Dr. Kenneth Fent (NIOSH Hazard Evaluations and Technical Assistance Branch, Division of Surveillance, Hazard Evaluations and Field Studies) on a joint research project regarding dermal exposures to firefighters. They performed analyses of a series of exhaled breath samples collected from firefighters immediately before and after suppression of structural burns. This collaboration resulted in a major NIOSH report (Fent et al., NIOSH Report #2010 0156 3196, 2013), and also a jointly authored scientific article published in the *Annals of Occupational Hygiene* (Fent et al., 2014). In fact, the article was so highly regarded that one of the figures was chosen as the cover art for the August 2014 issue. Dr. Fent was a NIOSH trainee in our NIOSH ERC Industrial Hygiene Program and received his PhD in Environmental Science and Engineering in 2008 under the guidance of Professor Leena Nylander-French. He then joined NIOSH Cincinnati where he is pursuing a number of occupational exposure projects. This study, the collaborative nature of our OES Program well beyond graduation, and its importance to the safety and well-being of the firefighters demonstrates the value of the ongoing NIOSH ERC support in developing the next generation of working Occupational Safety professionals. In addition, the continuity provided by the NIOSH grants serves as a conduit for successful collaborations among faculty, current students, and working graduates of the program.

There was another important collaboration with NIOSH and OES Program. Dr. Nylander-French, OES Director, and Zachary Robbins, OES trainee, begun a collaboration with NIOSH investigators led by Christine West (NIOSH Hazard Evaluations and Technical Assistance Branch, Division of Surveillance, Hazard Evaluations and Field Studies) of on a study of aircraft repair workers who are exposed to 1,6-hexamethylene diisocyanate monomer and oligomers. This research is focused at developing and validating specific urine and blood biomarkers of HDI monomer and oligomer exposures.

Dr. Rebecca Fry, OES faculty member, received Gillings School of Global Public Health Teaching Innovation Award in 2014. Eight awardees were selected by their students, one from each academic unit at the School. First presented in February 2012, the awards honor faculty members who “improve the learning environment by integrating new technologies, engaging students in interactive activities, employing creative assessment methods, and introducing and incorporating progressive curriculum ideas into the classroom.” The teaching innovation initiative was developed out of the School’s SPH2020 efforts and through a teaching and learning task force, who recommended identification, encouragement and reward of high-quality teaching, enhanced technology and applications for teaching and learning, and identification and support of faculty members who are early adopters of curriculum innovation.

Continuing Education
Director: Kathleen Buckheit

During the fiscal year of July 1, 2013 through June 30, 2014, NC OSHERC Continuing Education (CE) Program has provided **141 offerings** for **5280 participants** from all disciplines of occupational and environmental safety and health areas. The courses offered are available on “Table 2. ERC Continuing Education Data” reported to NIOSH. The CE Program objectives have been met, reaching all states in the Southeast region with a national and international following. Several collaborations with the other ERCs in the Southeast region have continued to

be fulfilling and successful. It is reported by students that because of this Program, they have been able to work more safely and maintain OSHA and EPA compliance for their businesses. Many have received promotions because of the education received and the Technician Certificate Programs completed. A significantly higher than national passing rates for all the Certification Review Courses has been consistently achieved. The new online course, "Fundamentals of Occupational Safety," was completed this year. This joins the successful "Fundamentals of Industrial Hygiene" course, as the second of the required Technician Certificate Program courses available online. Several new courses were offered and include: "Safety Boot Camp for Program Managers," "A Layered Approach to Hazard Recognition", and "Winning with a Successful Safety Culture." The implementation of a new UNC online registration system resulted in CE programmatic issue when it did not require registrants to complete the information on the participant's employer and profession information. As a result of procuring this information retroactively from two Email surveys and many telephone calls to the participants, and a review of previous registrations for repeat participants, the Table 2. ERC CE Data Table was completed as accurately as possible. Where it is not possible to obtain the information, the table's Comment box identifies that the demographic data are not available. For the current fiscal year, the software for the registration system is being addressed with the vendor as an urgent priority to make the profession and employer required fields. In the meantime, we are collecting that information at registration onsite on the first day of the course.

Outreach

Outreach for all of the NC OSHERC Programs is extensive and involves many faculty and staff involved with national, international, and many local and state chapters of professional associations touching thousands of occupational safety and health professionals and workers of all kinds. This Outreach includes the following:

1. Academy of Certified Hazardous Materials Managers (ACHMM) local chapters - education committee; presenters, loan equipment, and resources;
2. American Association of Occupational Health Nurses (AAOHN) national, state and local chapters – members and chairs of several committees, Board of Directors, provide resources, presenters, and regular journal contributions, and developing online training;
3. American College of Occupational and Environmental Medicine (ACOEM) national and regional chapters – members of committees, presenters, loan equipment, and present regional symposium;
4. American Conference of Governmental Industrial Hygienists: Biological Exposure Indices Committee;
5. American Industrial Hygiene Association (AIHA) national and regional chapters - education committees, presenters, loan equipment, and provide resources;
6. American Society for Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) - committee member for Standard 188P "Legionellosis: Risk Management for Building Water Systems";
7. American Society of Safety Engineers (ASSE) national, regional, and state chapters - education committees, presenters, loan equipment, and provide resources;
8. Association of Occupational and Environmental Clinics (AOEC) - several committees;
9. Association of Occupational Health Professionals (AOHP) - committees, presenters, and resources;
10. CDC Laboratory Safety Advisory Group to the Advisory Council of the Director – member
11. FBI - JASON Summer Study on Chemical Exposures (Weapons of Mass Destruction Directorate (WMDD)) - Invited Subject Matter Expert;

12. Hanes Brands, Inc. (Sara Lee Int'l) - created extensive corporate OH clinical guidelines;
13. Health Physics Society (HFS) - educational committee and presenter;
14. Human Factors Society (HFS) local and national chapters - educational committee, and presenters - current research progress in human-factors and ergonomics;
15. IBM - Assessment of Workplace Wellness Program;
16. Institute of Industrial Engineers (IIE) Raleigh Chapter- presentations, lab equipment demonstrations, current research progress in human-factors and ergonomics;
17. Institute of Occupational Medicine (IOM) – members of several committees and Chair;
18. International Association of Breath Association Conference (Poland) - Organizing Committee;
19. International Commission on Occupational Health (ICOH) - ICOH Vice-President, Secretary of Scientific Committee on OHN; Epidemiology, presenters, and committee members and Chairs;
20. National Academy of Sciences/National Research Council, Institute of Medicine: Committee on Inorganic Arsenic and Committee on Acute Exposure Guideline Levels - committee members;
21. NIEHS Gulf Long-Term Follow-Up Study for Oil Spill Clean-Up Workers and Volunteers, Exposure Assessment Workgroup - member;
22. NIH, US PHS, US DHHS – Reviewer of National Toxicology Program's Toxicity Report;
23. NIOSH - Board of Scientific Counselors (BSC) - Chair; NIOSH World Trade Center – Scientific /Technical Advisory Committee - member; NIOSH - Technical Advisor/Reviewer for Immediately Dangerous to Life or Health (IDLH) Value Profiles, and Technical Advisor and Reviewer for Skin Notation Project; National Personal Protective Technology Lab (NPPTL) - Respiratory Protection committees;
24. NC Agricultural & Technical State University - Advisory Board, resources, equipment, and CE;
25. NC Department of Transportation - seminar - driver distraction/performance and on-road signage;
26. NC Emergency Response System (EMS) Rapid Response Team (RRT) - Advisory Board;
27. OSHA and various construction workers' Unions – Nail gun research, advisories, and injury prevention;
28. Pittsburgh Conference and Exposition (Chicago) - Symposium Organizer;
29. Scientific Exchange Series of Human Movement Science (HMSC) – presentations;
30. University seminars: University of NC at Chapel Hill, Duke University, East Carolina University, University of Rostock (Germany), Laurentian University (Ontario), University of Buffalo (NY), NC State University (Psychology Department); Northwestern University (Chicago), Princeton University (NJ);
31. Women in Science and Engineering (WISE) student organization – seminar on ergonomic research;
32. 248th Analytical Chemical Society Meeting (San Francisco) - Organizing Committee and Co-host Technical Symposium: "Monitoring and Evaluating Environmental Exposures";
33. Publications per year - approximately 50; and
34. Presentations per year - approximately 60